A **dilation** is a transformation in which a figure stretches or shrinks depending on the dilation's **scale factor**. A figure *stretches* if $k > 1$ and *shrinks* if $0 < k < 1$. A figure and its dilated image are similar.
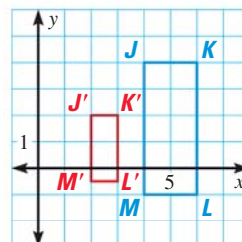
EXAMPLE Dilate *JKLM* using a scale factor of 0.5.

The scale factor is $k = 0.5$, so multiply every coordinate by 0.5. Use $(x, y) \rightarrow (0.5x, 0.5y)$ with each vertex.

$J(4, 4) \rightarrow J'(0.5 \cdot 4, 0.5 \cdot 4) = J'(2, 2)$
$K(6, 4) \rightarrow K'(0.5 \cdot 6, 0.5 \cdot 4) = K'(3, 2)$
$L(6, -1) \rightarrow L'(0.5 \cdot 6, 0.5 \cdot (-1)) = L'(3, -0.5)$
$M(4, -1) \rightarrow M'(0.5 \cdot 4, 0.5 \cdot (-1)) = M'(2, -0.5)$

Graph the new vertices. Then draw the image.

PRACTICE

Find the coordinates of $N(-3, 8)$ after the given transformation. For rotations, rotate about the origin.

1. Rotate 180°.
2. Reflect in *x*-axis.
3. Translate up 3 units.

4. Reflect in *y*-axis.
5. Rotate 90° clockwise.
6. Translate left 5 units.

7. Rotate 90° counterclockwise.
8. Translate right 2 units and down 9 units.

Transform $\triangle PST$. Graph the result. For rotations, rotate about the origin.

9. Reflect in *x*-axis.
10. Rotate 90° counterclockwise.

11. Rotate 90° clockwise.
12. Translate down 7 units.

13. Reflect in *y*-axis.
14. Translate left 4 units.

15. Rotate 180°.
16. Translate right 2 units.

17. Translate right 1 unit and up 4 units.

18. Translate left 6 units and up 2 units.
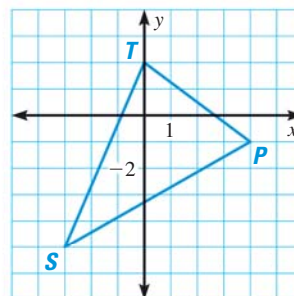
The coordinates of the vertices of a polygon are given. Draw the polygon. Then find the coordinates of the vertices of the image after the specified dilation, and draw the image.

19. (1, 3), (3, 2), (2, 5); dilate using a scale factor of 3

20. (2, 8), (2, 4), (6, 8), (6, 4); dilate using a scale factor of $\frac{3}{2}$

21. (3, 3), (6, 3), (3, −3), (6, −3); dilate using a scale factor of $\frac{1}{3}$

22. (2, 2), (2, 7), (5, 7); dilate using a scale factor of 2

23. (2, −2), (6, −2), (4, −6), (0, −6); dilate using a scale factor of $\frac{1}{2}$